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To: Examiner Parviz Hassanzadeh, Unit 1763

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Message:

In re Application of

Stephen E. Savas

Group Art Unit: 1763

Application No.: 10/053,138

Examiner: Parviz Hassanzadeh

Filed: 01/18/2002

For: Pulsed Plasma Processing of Semiconductor Substrates

Please see attached Transmittal, Fee Transmittal, and Response to Office Action in the above-referenced matter.

Ref: 14912.786

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PAGE 1/7 * RCVD AT 1/7/2004 9:10:16 PM [Eastern Standard Time] * SVR:USPTO-EFAXF-1/0 * DNIS:8729306 * CSID:650 493 6811 * DURATION (mm-ss):02-30

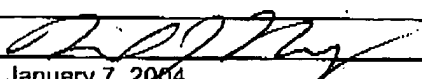
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TRANSMITTAL FORM (to be used for all correspondence after initial filing)		Application Number	10/053,138
		Filing Date	January 18, 2002
		First Named Inventor	Stephen E. Savas
		Art	1763
		Examiner	Parviz Hassanzadeh
Total Number of Pages in This Submission	7	Attorney Docket Number	14912.786

ENCLOSURES (Check all that apply)		
<input checked="" type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Fee Attached <input checked="" type="checkbox"/> Amendment/Reply <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits/declaration(s) <input checked="" type="checkbox"/> Extension of Time Request <input type="checkbox"/> Express Abandonment Request <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Certified Copy of Priority Document(s) <input type="checkbox"/> Response to Missing Parts/Incomplete Application <input type="checkbox"/> Response to Missing Parts under 37 CFR 1.52 or 1.53	<input type="checkbox"/> Drawing(s) <input type="checkbox"/> Licensing-related Papers <input type="checkbox"/> Petition <input type="checkbox"/> Petition to Convert to a Provisional Application <input type="checkbox"/> Power of Attorney, Revocation <input type="checkbox"/> Change of Correspondence Address <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Request for Refund <input type="checkbox"/> CD, Number of CD(s) _____	<input type="checkbox"/> After Allowance Communication to Group <input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences <input type="checkbox"/> Appeal Communication to Group (Appeal Notice, Brief, Reply Brief) <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Status Letter <input type="checkbox"/> Other Enclosure(s) (please identify below): _____
Remarks		

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT	
Firm	Michael J. Murphy, Reg. No. 37,404; Customer No. 21971
Individual	
Signature	
Date	January 7, 2004




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FEE TRANSMITTAL for FY 2004				<i>Complete if Known</i>																																																																																																																																																																																											
<i>Patent fees are subject to annual revision. Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid. See Forms PTO/SB/09-12. See 37 C.F.R. §§ 1.27 and 1.28.</i>				Application Number	10/053,138																																																																																																																																																																																										
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1. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge indicated fees and credit any over payments to: Deposit Account Number <u>23-2415 (Docket No. 14912.786)</u> Deposit Account Name <u>Wilson Sonsini Goodrich & Rosati</u> <input checked="" type="checkbox"/> Charge Any Additional Fee Required Under 37 CFR §§ 1.16 and 1.17				3. ADDITIONAL FEES <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <thead> <tr> <th>Large Fee Code</th> <th>Entity Fee (\$)</th> <th>Small Fee Code</th> <th>Entity Fee (\$)</th> <th>Fee Description</th> <th>Fee Paid</th> </tr> </thead> <tbody> <tr><td>105</td><td>130</td><td>205</td><td>65</td><td>Surcharge - late filing fee or oath</td><td></td></tr> <tr><td>127</td><td>50</td><td>227</td><td>25</td><td>Surcharge - late provisional filing fee or cover sheet</td><td></td></tr> <tr><td>139</td><td>130</td><td>139</td><td>130</td><td>Non-English specification</td><td></td></tr> <tr><td>147</td><td>2,520</td><td>147</td><td>2,520</td><td>For filing a request for reexamination</td><td></td></tr> <tr><td>112</td><td>920*</td><td>112</td><td>920*</td><td>Requesting publication of SIR prior to Examiner action</td><td></td></tr> <tr><td>113</td><td>1,840*</td><td>113</td><td>1,840*</td><td>Requesting publication of SIR after Examiner action</td><td></td></tr> <tr><td>115</td><td>110</td><td>215</td><td>55</td><td>Extension for reply within first month</td><td></td></tr> <tr><td>116</td><td>420</td><td>216</td><td>210</td><td>Extension for reply within second month</td><td></td></tr> <tr><td>117</td><td>950</td><td>217</td><td>475</td><td>Extension for reply within third month</td><td>950</td></tr> <tr><td>118</td><td>1,480</td><td>218</td><td>740</td><td>Extension for reply within fourth month</td><td></td></tr> <tr><td>128</td><td>2,010</td><td>228</td><td>1,005</td><td>Extension for reply within fifth month</td><td></td></tr> <tr><td>119</td><td>330</td><td>219</td><td>165</td><td>Notice of Appeal</td><td></td></tr> <tr><td>120</td><td>330</td><td>220</td><td>165</td><td>Filing a brief in support of an appeal</td><td></td></tr> <tr><td>121</td><td>290</td><td>221</td><td>145</td><td>Request for oral hearing</td><td></td></tr> <tr><td>138</td><td>1,510</td><td>138</td><td>1,510</td><td>Petition to institute a public use proceeding</td><td></td></tr> <tr><td>140</td><td>110</td><td>240</td><td>55</td><td>Petition to revive - unavoidable</td><td></td></tr> <tr><td>141</td><td>1,330</td><td>241</td><td>665</td><td>Petition to revive - unintentional</td><td></td></tr> <tr><td>142</td><td>1,330</td><td>242</td><td>665</td><td>Utility issue fee (or reissue)</td><td></td></tr> <tr><td>143</td><td>480</td><td>243</td><td>240</td><td>Design issue fee</td><td></td></tr> <tr><td>144</td><td>640</td><td>244</td><td>320</td><td>Plant issue fee</td><td></td></tr> <tr><td>122</td><td>130</td><td>122</td><td>130</td><td>Petitions to the Commissioner</td><td></td></tr> <tr><td>123</td><td>50</td><td>123</td><td>50</td><td>Petitions related to provisional applications</td><td></td></tr> <tr><td>126</td><td>180</td><td>126</td><td>180</td><td>Submission of Information Disclosure Stmt</td><td></td></tr> <tr><td>581</td><td>40</td><td>581</td><td>40</td><td>Recording each patent assignment per property (times number of properties)</td><td></td></tr> <tr><td>146</td><td>770</td><td>246</td><td>385</td><td>Filing a submission after final rejection (37 CFR 1.129(a))</td><td></td></tr> <tr><td>149</td><td>770</td><td>249</td><td>385</td><td>For each additional invention to be examined (37 CFR 1.129(b))</td><td></td></tr> <tr><td colspan="6">Other fee (specify)</td></tr> <tr><td colspan="6">Other fee (specify) 55/110 Terminal Disclaimer</td></tr> <tr><td colspan="6">* Reduced by Basic Filing Fee Paid</td></tr> <tr><td colspan="5" style="text-align: right;">SUBTOTAL (3)</td><td>\$950</td></tr> </tbody> </table>		Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Description	Fee Paid	105	130	205	65	Surcharge - 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Attorney Docket No. 14912.786

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Alexandria VA 22313-1450

Sir:

In an office action dated July 7, 2003, the Examiner rejected pending claims 44-82. The Examiner rejected claims 44-56 and 60-63 under 103(a) as being unpatentable over U.S. Patent 5,289,010 ("Shohet") in view of WO 91/10341 ("Savas") and rejected claims 57-59 and 64-82 under 103(a) as being unpatentable over Shohet in view of Savas and further in view of U.S. Patent 4,858, 516 ("Corn"). In this response, applicant respectfully traverses the Examiner's rejection of pending claims 44-82.

Claims 44 and 64 are independent claims and claims 45-63 and claims 65-82 depend from those claims, respectively.

Claim 44 is directed at a method of plasma processing a semiconductor substrate comprising, among other things, inductively coupling power to a plasma using high power cycles and low power cycles such that greater than about 5kW of power is coupled to the plasma during each high power cycle; coupling power to a substrate support using high power cycles and low power cycles; and

synchronizing such that the high power cycles are applied to the substrate support substantially during the time that low power cycles are applied to the plasma.

Claim 64 is directed at a method of plasma processing a semiconductor substrate comprising, among other things, inductively coupling power to a plasma using high power cycles and low power cycles with a duty cycle of about 5 to 30 percent; coupling power to a substrate support using high power cycles and low power cycles; and synchronizing such that the high power cycles are applied to the substrate support substantially during the time that low power cycles are applied to the plasma.

In rejecting independent claims 44 and 64, the Examiner relies upon Shohet as teaching a plasma power source 36 modulated by a pulse modulator 38 such that "whereas as shown in Fig. 3, plasma excitation is on except during the time a pulsed voltage is applied to the substrate support".

Shohet describes a plasma source ion implantation process and apparatus. A plasma may be created by ionizing a neutral gas. However, unwanted species may also be ionized when generating the plasma. See col. 1, lines 65-67 and col. 2, lines 9-10 and 17-21. Shohet teaches the use of ion cyclotron resonance (ICR) in the presence of a magnetic field to purify the ions and drive unwanted ion species into resonance and into a collection plate or other collection means. See col. 2, lines 21-30. The frequency, magnetic field, electric field and other parameters are selected in relation to one another to achieve the desired resonance and resulting purification. See col. 4, lines 6-68 and col. 5, lines 1-24. In Figures 1 and 2 of Shohet, a magnet 22 provides a magnetic field between plate-like electrodes 17 and plates 19 to form the ICR system. This ICR system is separate from the plasma source 16 and plasma source power supply 36 used to ionize the gas.

Figure 3 in Shohet, referenced by the Examiner, illustrates acceleration pulses 61 applied to the target and the ICR excitation 64 and 69 which are applied to the excitation electrodes 17. See col. 7, lines 39-51. The ICR excitation signals 64 and 69 in Figure 3 are the signals used to purify ions after the plasma is generated and are not signals used to generate the plasma. See also col. 6, lines 14-20

(the plasma source 16 creates the plasma which drifts into the ion purification region and "Once the ions are in the ion purification region, the time varying electric field from the excitation electrode 17 serves to sweep out the undesired species").

While the ICR in Shohet applies an excitation signal to the plasma, it uses a magnet and plate-like electrodes (and the corresponding excitation signals in Figure 3 of Shohet) and does not teach or suggest inductively coupling power into the plasma in the manner set forth in independent claims 44 and 64 of the present application. Moreover, there is no suggestion to substitute the plasma source or power signals in Savas for the ICR purification in Shohet. Shohet teaches that the frequency, magnetic field, electric field and other parameters are selected in relation to one another to achieve the desired resonance. There is no teaching or suggestion to combine the higher power levels of Savas cited by the Examiner to the ion purification excitation signals in Figure 3 of Shohet. In addition, the plasma source in Savas does not purify ions for ion implantation as desired in Shohet and substituting it for the ICR in Shohet would render Shohet inoperable for its intended purpose. In addition, substituting the plasma source in Savas for the plasma source in Shohet also would not result in the claimed invention, because the excitation signals shown in Figure 3 do not apply to the power source (and, in any event, the plasma source of Savas does not use high and low power cycles of the type required by independent claims 44 and 64).

Corn also does not make up for the deficiencies in Shohet. Corn describes parallel plate electrodes which would capacitively (rather than inductively) couple power into a plasma. High and low frequency signals are applied to the electrodes for an etch process. Corn does not teach or suggest inductively coupling power into a reactor in the manner set forth in independent claims 44 and 64. In addition, there is no suggestion to combine the duty cycles used for the etch process in Corn with the ion implantation reactor described in Shohet. The ion implantation reactor uses high voltage

acceleration pulses to implant ions and does not use dual RF frequency signals of the type used for etching in Corn.

Methods using inductively coupled plasmas in accordance with the claimed invention can be used to provide important advantages by reducing charge build up and microsteering, a problem not recognized or addressed by the above references.

In view of the above, applicant believes that independent claims 44 and 64 are not anticipated or rendered obvious by Shohet either alone or in view of Savas and Corn. Therefore, claims 44 and 64 are believed to be patentable. Claims 45-63 and claims 65-82 depend from independent claims 44 and 64 and, as a result, are also believed to be patentable.


In view of the foregoing, it is believed that all of the pending claims are in condition for allowance. Applicant respectfully requests reconsideration, allowance and passage to issue of the claims as amended.

The Commissioner is authorized to charge any additional fees which may be required, including petition fees, or credit any overpayment to Deposit Account No. 23-2415 (Docket No. 14912-786).

Respectfully submitted,

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